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LOBLOLLY PINE SEED SOURCE AND HYBRID TESTS IN SOUTHERN ILLINOIS

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by

Leon S. Minckler

Most open nonagricultural land in southern Illinois and adjacent areas best suited to growing timber should be planted to pines. In this region loblolly and shortleaf pine will survive and grow successfully on the soils of old fields depleted by constant cropping and erosion. Plantings of native hardwoods usually have failed except on the moister sites with relatively deep soils.

Estimates of the area in southern Illinois which should be reforested vary somewhat; Spaeth1/ gives a conservative figure of three-quarters of a million acres for the 16 southernmost counties. Only a very small portion of this area has been planted to date. Many years will be needed to complete the job, but it should be done with the greatest possible efficiency and technical skill.

Southern pines, loblolly and shortleaf, offer the most promise for reforestation in this area. However, the nearest native loblolly stands occur in east-central Arkansas and extreme southern Tennessee. Except for a few scattered trees along the Mississippi River bluff in southwestern Illinois, the nearest shortleaf pine stands occur in the Missouri Ozarks.

Both European and American investigations have shown conclusively that the geographic source of seed may have an important effect on the success of plantations, even within the natural range of a species.2/ 3/ 4/ When a species is planted outside its natural range, it is even more important that the seed used be adapted, as nearly as possible, to conditions within the area planted. Another way to establish good plantations is to use hybrids which are suited to the climate and soil conditions of the area and at the same time have good form and rapid growth. This paper gives third-year results of tests of pine hybrids and loblolly pine geographic seed sources conducted in the upland sections of southern Illinois.

1/ J. N. Spaeth. Forests of southern Illinois. So. Ill. Booklet No. 4. Ill. Univ., Urbana. 1948.

2/ Bertil Lindquist. Genetics in Swedish forestry practice. 173 pp., illus. Stockholm. 1948.

3/ Paul O. Rudolf. Local red pine seed develops best plantations. Lake States Forest Expt. Sta. Tech. Note No. 296. 1948.

4/ Philip C. Wakeley. Planting the southern pines. Southern Forest Expt. Sta. Occas. Paper No. 122. 1951.

DESCRIPTION OF EXPERIMENTS

Seed for the geographic source tests was furnished from regular lots collected by various state forestry departments. Each source included seed from many individual trees. The hybrid seed was furnished by the California Forest and Range Experiment Station and was produced by controlled pollination between loblolly and shortleaf pines. All seed was planted in a single nursery bed at the Union State Nursery, Jonesboro, Illinois, in the spring of 1948. The resulting seedlings were planted in randomized, replicated plots in March 1949 on the Shawnee National Forest and the Kaskaskia Experimental Forest.

Loblolly seed was obtained from six different seed sources. Seedlings from each source were planted in different plots. Each plot contained 216 trees spaced 6 by 6 feet. These six plots, side by side in a field, constituted an experimental block. Five such blocks were established on typical old fields scattered over the uplands of southern Illinois.

Only a small number of seedlings of two loblolly-shortleaf pine hybrids were available for planting. Six 36-tree plots of each hybrid were established on old fields in the uplands of southern Illinois. For comparison, a small number of 1-0 loblolly pines from a Polk County, Tennessee, source were included in this study.

RESULTS

Loblolly Pine Seed Sources

By the end of the first year, the heights of loblolly pine trees from the different sources were significantly different.5/ Trees from South Carolina and Mississippi sources were significantly taller than those from all other sources. The Arkansas-source trees were shortest, and trees from Maryland, Virginia, and North Carolina sources were intermediate. However, the unusually cold winter of 1950-51 severely damaged loblolly trees from the North Carolina, South Carolina, and Mississippi sources.6/ This changed the order of survival and height growth of the different sources. At the Union State Nursery the same cold winter killed all 1-0 loblolly nursery stock from an eastern South Carolina source while nearby beds of stock from Maryland and Arkansas sources were virtually undamaged.

5/ L. S. Minckler. Effect of seed source on height growth of pine seedlings. Jour. Forestry 48(June):430-431. 1950.

6/ L. S. Minckler. Southern pines from different geographic sources show different responses to low temperatures. Jour. Forestry 49:915-916. 1951.

At the end of three seasons, the average loblolly survival on all blocks ranged from 96 percent for the Maryland source to 76 percent for the Mississippi source (table 1). Average height growth ranged from 3.6 to 2.8 feet. The more susceptible sources suffered severe frost damage on three blocks but relatively little damage on the remaining two blocks. Although differences in frost damage are ordinarily related to topography and slope exposure, it was impossible to determine definitely why some blocks had relatively light damage while others were severely damaged. All blocks were located on slopes or broad ridges.

The 2-year height growth for trees from Maryland and Virginia sources (table 1) is significantly better than that of all other sources on all blocks, including the three severely damaged ones.7/ Other growth comparisons are not significant.

Differences between third-year survival of the different sources or groups of sources are either significant8/ or highly significant.9/ Based on survival, the sources tend to fall into three groups with Maryland and Virginia best, Arkansas intermediate, and North Carolina, South Carolina, and Mississippi poorest.

By the end of the third year after planting, the appearance of trees from the northern sources was quite different from the appearance of those from the southern sources (fig. 1). Trees from the northern sources were dark green, well-formed, and the terminals and branch leaders were intact and straight. On the frost-damaged blocks, trees from Mississippi, North Carolina, and South Carolina were ill-formed because their terminals and branch leaders had been killed. These trees were bushy, spindly, and a lighter green. The severe cold of 1950-51 was directly responsible for the low survival and at least partially responsible for the poorer average height growth.

Based on three criteria--survival, height growth, and appearance--the trees from seed collected in Maryland and Virginia were definitely superior for planting in the upland old fields of southern Illinois. Trees from the Arkansas source were also satisfactory, but those from the North Carolina, South Carolina, and Mississippi sources were definitely inferior.

7/ Significant at the 1 percent level. Probability less than 1 in a 100 that difference is due to chance.

8/ Significant at the 5 percent level. Probability less than 1 in 20 that difference is due to chance.

9/ Significant at the 1 percent level.

Table 1.--Average survival and height growth of loblolly pine by seed sources

Seed source	Survival 3 years after planting		Height growth; second plus third years	
	Three damaged blocks[1]	All five blocks	Three damaged blocks[1]	All five blocks
	Percent	Percent	Feet	Feet
Worcester County, Maryland	96	96	3.3	3.6
Matthews County, Virginia	93	94	3.1	3.5
Southwestern Arkansas	84	86	2.5	2.8
Pender County, North Carolina	78	84	2.4	2.8
South Carolina; section unknown	72	80	2.5	3.0
Mississippi; section unknown	66	76	2.3	2.9

[1] The three blocks where trees suffered severe frost damage during the third winter.

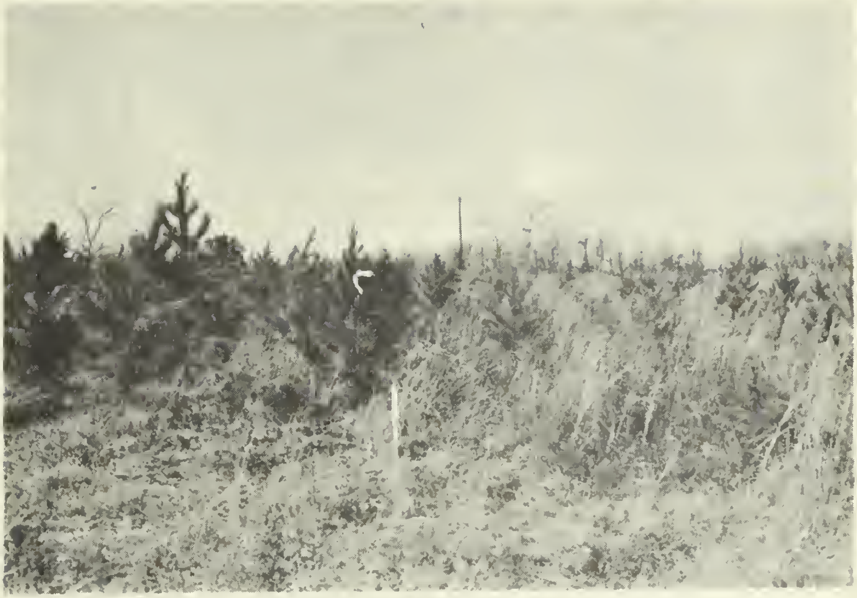

Figure 1.--Loblolly pines grown from seed from different sources show marked differences in appearance 3 years after planting. Trees to the left of the white 2½-foot plot stake are from the Worcester County, Maryland, source. Those to the right are from the Pender County, North Carolina, source. The Maryland trees are taller, have denser and darker foliage, and show better form and survival.

Pine Hybrids

In the pine hybrid tests, Hybrid 2 made significantly greater growth than Hybrid 1[10] (table 2). Although the Tennessee-source loblolly grew better than either hybrid, this is of no particular significance. The loblolly-shortleaf pine hybrids should not be judged solely on the basis of height growth comparisons with pure loblolly. Hybrids may have other advantages including a better adaptation to northern conditions than pure loblolly while retaining most of the growth vigor characteristics of that species. The hybrids may also show better form and greater disease and insect resistance than one or both of the parent species. Hybrids may extend beyond the range of either parent species while retaining some of the more desirable features of both species.

Both the Tennessee-source loblolly and Hybrid 2 made better growth than the best source (Maryland) in the geographic seed source plots. These two series of plots were on similar sites, often on the same fields, but it is not certain that conditions were directly comparable and statistical tests cannot be made between them. It appears, however, that Tennessee loblolly was superior in initial growth to Maryland loblolly, and that Hybrid 2 grew at least as well as Maryland loblolly.

Pine Hybrid 2 is three-fourths loblolly, one-fourth shortleaf pine, and looks more like loblolly. Hybrid 1 is half and half and most trees look more like shortleaf pine. The geographic parentage of both hybrids is the same--North Carolina for the shortleaf component and Virginia for the loblolly component. Neither the hybrids nor the Tennessee loblolly were damaged by freezing. The northern parentage of the loblolly portion of the hybrids and the cross with shortleaf pine no doubt account for their resistance to frost damage.

CONCLUSIONS

1. Until the results of more comprehensive research are available, loblolly pine seed for trees to be planted in the southern Illinois uplands or similar adjacent areas should be collected from natural stands in Maryland, Virginia, Tennessee, or Arkansas. Later results of the experimental plots already established may show further advantages or disadvantages of the various sources.

2. Trees produced from deep South or southeastern Coastal Plain seed sources may suffer severe damage from cold when grown in southern Illinois. Because of the cold, mortality

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[10] Significant at the 5 percent level.

Table 2.--Average survival and height growth of two pine hybrids and two loblolly pines[1]

Hybrid or source	Third year survival	Height growth; second plus third years
	Percent	Feet
Hybrid 1 - shortleaf x loblolly pine, open pollinated and interpollinated	88	3.1
Hybrid 2 - loblolly pine x (shortleaf x loblolly)	82	3.7
Loblolly - Polk Co., Tennessee, source	88	4.3
Loblolly - Worcester Co., Maryland, source[2]	96	3.6

[1] Each value in table is the mean of six plots of 36 trees each, except Maryland which is the mean of five plots of 216 trees each.

[2] The best of six sources of loblolly pine tested in the geographic seed source study (table 1).

may be high, growth may be slow, and the trees may show poor form.

3. The two loblolly-shortleaf hybrids tested in southern Illinois were free from frost damage and showed good survival. The three-fourths loblolly and one-fourth shortleaf pine hybrid grew better than all but one of seven pure loblolly sources tested. Definite conclusions regarding the possibilities of hybrid pines in this area must await the completion of much more comprehensive tests.

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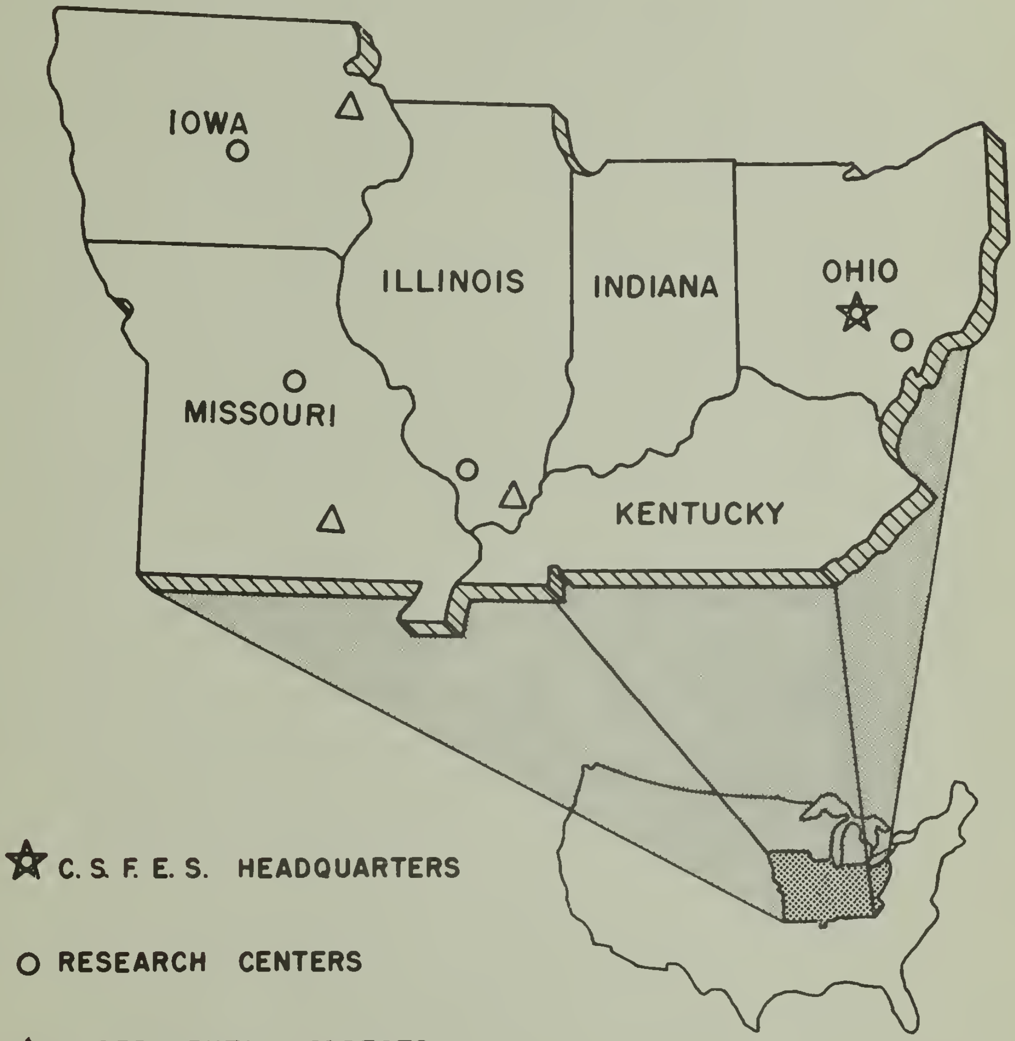

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